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FLOOD INSURANCE STUDY

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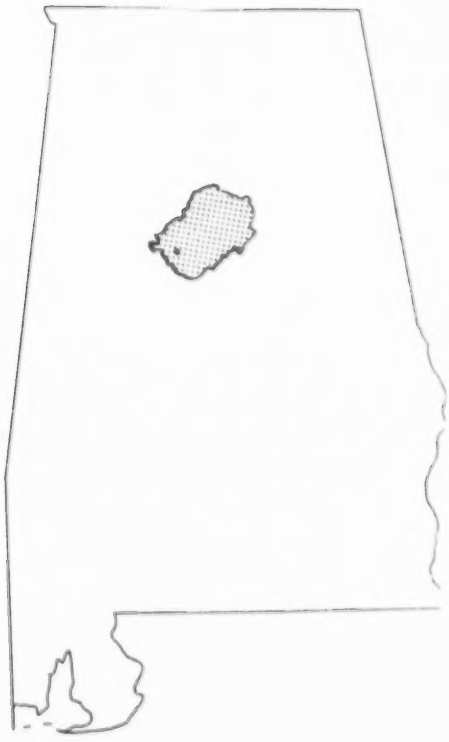
CITY OF MIDFIELD, ALABAMA
JEFFERSON COUNTY



JULY 16, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 010127

FEMA-209

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FLOOD INSURANCE STUDY
CITY OF MIDFIELD, JEFFERSON COUNTY, ALABAMA

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the City of Midfield, Jefferson County, Alabama, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of the information will be to convert the City of Midfield to the regular program of flood insurance by the Federal Insurance Administration (FIA). Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

Community base map selection and the identification of streams requiring detailed study were agreed to in meetings attended by personnel of the U.S. Geological Survey (USGS), the Federal Insurance Administration (FIA) and officials of the City of Midfield in May-June 1976. The areas for detailed study were reviewed by the FIA in May-June 1976, the limits were updated by the FIA in September 1976, and were confirmed in the contract with Betz-Converse-Murdoch-Inc., (BCM) on September 27, 1976. Hydrologic analyses and flood profiles for the Valley Creek and the no-name branch of the Valley Creek within the City of Midfield were coordinated with those being developed concurrently or developed previously by the U.S. Army Corps of Engineers (COE). There are no previous flood insurance studies for the Valley Creek.

During the course of the work by Betz-Converse-Murdoch-Inc., flood elevations, flood boundaries and floodway delineations were reviewed with community, county and state officials. On January 29, 1980, the results of the work were reviewed at a final coordination meeting attended by personnel of BCM, the FIA and officials of the City of Midfield.

1.3 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by Betz Converse Murdoch Inc., for the Federal Insurance Administration under Contract No. H-4034. This work, which was completed in October 1978, covered all significant flooding sources in the City of Midfield.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Midfield, Jefferson County, Alabama. The area of study is shown on the Vicinity Map (Figure 1).

Areas not included in the scope of study were undeveloped and areas where the terrain is such that the 100-year base flood would be contained within the present ravine.

Specifically, streams draining areas not studied are:

1. The no-name branch of Valley Creek from its upstream intersection with the corporate limits to the confluence which is near the intersection of the lower corporate limit and the U.S. Steel Company High Line Ore Track.

2. The no-name branch of Valley Creek from its upstream origin near Woodward Road and Creel Street to its downstream confluence with Valley Creek.

Flooding caused by the overflow of Valley Creek was studied in detail. Also studied in detail was the flooding caused by unnamed Creek 46 from its crossing of U.S. Highway 11 near West Brookwood Road to its confluence with Valley Creek. Flooding on smaller streams in undeveloped parts of the city and shallow flooding caused by ponding of runoff were studied by approximate methods by Gannett, Fleming, Corddry and Carpenter, Inc. The approximate study areas in some instances are superseded by this detailed study.

2.2 Community Description

Midfield is located in the extreme central-southern part of Jefferson County in Township 18 South, Range 4 West. It had a 1970 population of 6,399 (U.S. census, 1970) and an estimate 7,179 in 1976. It is bordered on the north and east by Birmingham to the south by Roosevelt City and to the West by Fairfield.

The area is primarily residential. Small businesses and shops centered around the intersection of U.S. Highway 11 and Fairfield Road. U.S. Highway 11 runs essentially throughout the upper portion of the city in a northeast-southwest direction.

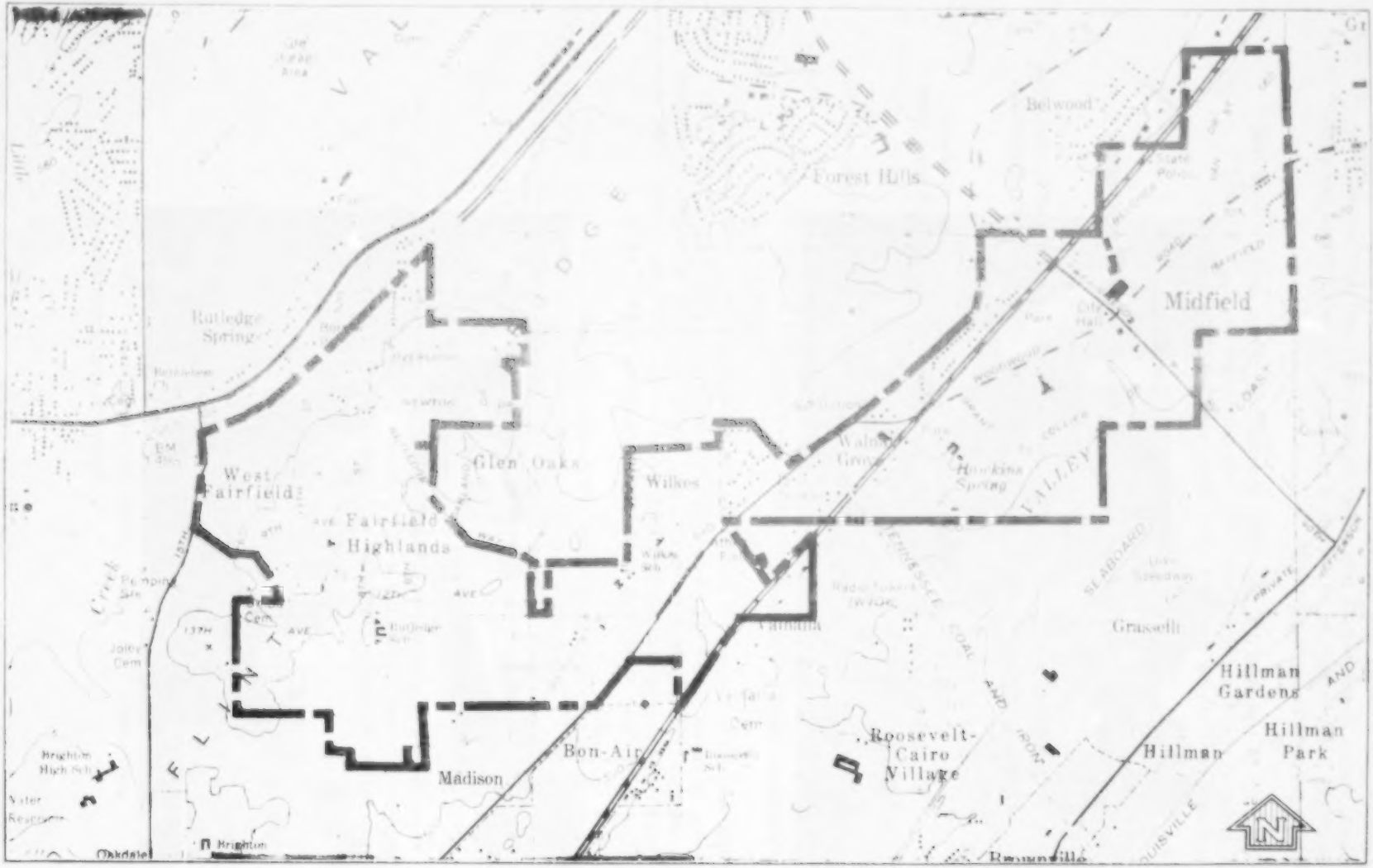


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Insurance Administration

CITY OF MIDFIELD, AL

(JEFFERSON COUNTY)

APPROXIMATE SCALE

2000 0 2000 3000 4000 Ft

VICINITY MAP

Residential development occurs throughout the city. The open space is along Valley Creek, which lies along the east and southeast boundary of Midfield. The terrain of the areas is relatively flat with slopes between three percent to eight percent.

The soils of the area are generally undulating, rolling, deep, upland and formed in chert and limestone with fair permeability, except along Valley Creek where the soils are clayey with lower permeability.

The soils are underlain by the Pottsville and Flody Formation.

The vegetation is mostly turfed lawns with very sparsely wooded open space areas.

The climate of the flood study area is typical of Jefferson County, moderate with mild winters and an average temperature of 63 F. The annual average rainfall is 54 inches.

Valley Creek along the southeastern border of the city and the no-name Creek flows from the northwest to southeast through to the northeast part of the city and eventually into the Valley Creek.

The drainage area at the downstream corporate limits is 26.16 square miles for Valley Creek.

2.3 Principal Flooding Problems

The terrain in the area is relatively flat throughout the city and there has been no major flooding problems since the extreme rainfall that occurred in March 1973. At that time, city hall had some water damages. The Woodward Road Bridge and the Midfield Street bridges because of restricted flow areas have some high water problems along Valley Creek.

Pictures of previous flooding are not readily available; however, Figure 2 shows the 100-year flood projected on the Midfield Road bridge crossing over the Valley Creek. Figure 3 shows the 100-year flood projected on the Collier Drive bridge crossing over Unnamed Creek 46.

2.4 Flood Protection Measures

The primary drainage within the city is by open ditches, along roads, open curbways along streets and culverts under roadways. There are no flood protection measures along the watercourses nor are any planned.

FIGURE 2: Bridge over Valley Creek on Midfield St. Upstream face of bridge.

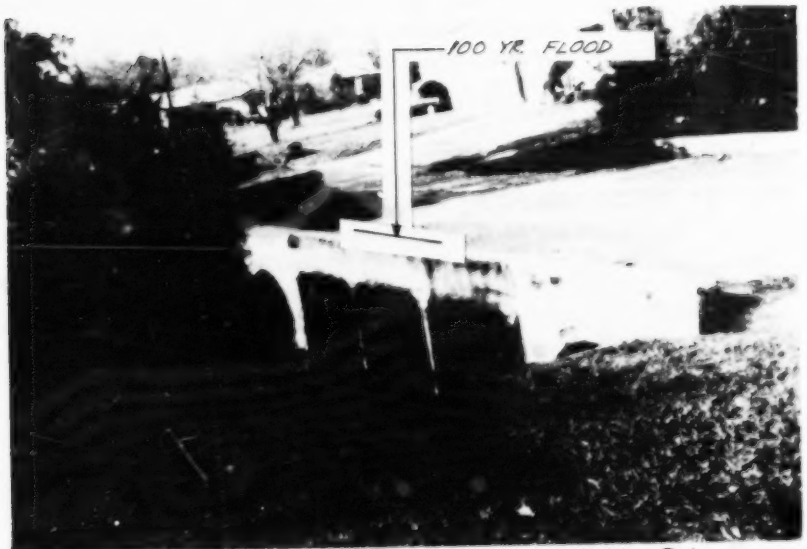


FIGURE 3: Bridge over unnamed stream on Collier Drive. Downstream face of bridge.

3.0 ENGINEERING METHODS

For flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Floods having recurrence intervals of 10-, 50-, 100-, and 500-years have been selected as having special significance for flood plain management and for flood insurance premium rates. The analyses reported here reflect current conditions in the drainage areas of the streams.

3.1 Hydrologic Analyses

Table 1 presents a summary of flow frequency discharge for the Valley Creek and Unnamed Creek 46.

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods on those portions of Valley Creek and its branches which were studied in detail.

For this study, a Log-Pearson Type III analysis is employed. The basis for the analysis is a report entitled "Floods in Alabama, Magnitude and Frequency Based on Data through September 30, 1971," published in 1973 by C.F. Hains (Reference 1) of the USGS. In his study, Mr. Hains fitted the Log-Pearson Type III distribution to the annual maximum discharges for 209 gaged sites in Alabama and 44 selected sites in adjacent states. The results of the Log-Pearson analysis were regressed against such parameters as drainage area, channel slope, storage and angle of main channel. A set of equations were developed which can be used to estimate flood discharges up to a 100-year recurrence interval for ungaged sites with drainage areas as small as one square mile. Since it is necessary to compute the 500-year flood discharges, standard curve fitting techniques are applied to Hains' coefficients to estimate the appropriate 500-year recurrence interval coefficients.

Hains' equations apply to rural areas. Since many of the areas in Jefferson County are urbanized, flows using these equations are adjusted. The adjustment is done by applying the procedures published by V.B. Sauer of the USGS in a report entitled "An Approach to Estimating Flood Frequencies for Urban Areas in Oklahoma," 1974 (Reference 2). The key parameters in Sauer's procedure are percent of the area storm sewered and percent impervious cover. Estimate of impervious cover were obtained by using a regression equation which relates population and employment densities to percent impervious cover. This regression equation was developed by BCM for the U.S. Environmental Protection Agency in a report entitled "Planning Methodologies for analysis of Land Use/Water Quality Relationships," October 1976 (Reference 3). The equation was developed with data from Pennsylvania and Oklahoma.

To determine if this equation applied in Jefferson County, Alabama, comparison estimates were made by using the equation with those obtained using a grid-counting technique on aerial photographs of Jefferson County. Ten aerial photographs were used. Each photograph covered approximately

three square miles of land area. In selecting photographs for use, particular attention was paid to including all types of urban land use categories. It was found that the regression equation compared very favorably with the grid-counting technique. The average difference in the estimates is 2.5 percent, and the standard deviation those differences is approximately 6 percent.

To learn the extent of the storm sewering, officials of Jefferson County and members of the USGS office in Tuscaloosa, Alabama, were interviewed Both groups agree that, with the exception of the City of Birmingham, storm sewering in Jefferson County is virtually non-existent. Even through storm sewering per se is not practiced outside the City of Birmingham, some improvements to drainage patterns generally occur through the process of urbanization. Other agencies doing similar studies throughout Alabama do consider improvement to drainage as an integral process of urbanization. To account for this relationship, it is assumed that the percent of the area influenced by improved drainage equals the percent of the impervious cover.

The peak discharge-drainage area relationships for the selected recurrence intervals are presented in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
VALLEY CREEK Midfield Road	22.27	9,880	13,940	16,040	21,440
UNNAMED CREEK 46 Collier Drive	1.27	1,130	1,670	1,930	2,660

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of Valley Creek and Unnamed Creek 46 in the City of Midfield were performed to provide estimates of the elevations of floods of the selected recurrence interval along the streams. The study was conducted by the detailed method.

Cross section data from the streams in that area were generally obtained from a combination of field measurements for below-water contours and photogrammetrically measured above-water contours. Cross sections were generally selected so that there would not be excessive conveyance changes between them nor more than 10 feet of flood water surface elevation difference between them. Selected structures including all bridges, culverts, and dams with the potential of controlling flood elevations, were field surveyed to obtain elevation data and hydraulic geometry.

The locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). Cross sections in this study are lettered to be continuous with the Flood Insurance Study for Jefferson County, Alabama. For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

Roughness coefficients (Manning's "n") were generally estimated by using considerable engineering judgment in examining recent aerial and ground level photographs of the structures, the flood plains, and the stream channels. Particular attention was paid to "n" values as they related to known gage stages. The stream number, stream names, and range of Manning's "n" values for all streams in this community that were studied at least in part by detailed methods are as follows:

Stream Number	Stream Name	Range of Manning's "n" Values	
		Channel	Flood Plain
35000	Valley Creek	.04	.1 to .04
46000	Unnamed Creek 46	.04	.07

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

Water surface profiles were developed using the HEC-2 (Reference 4) standard-step models. Profiles were determined for the 10-, 50-, 100-500-year floods. All starting water surface elevations were either the backwater of a stream at a confluence or the result of more than 1,000 feet of step-backwater computations. The Manning coefficients were adjusted to provide close correlation of water surface profiles with known water surface elevation as determined from flood data taken at USGS gaging sites.

All elevations used in this study are reference to National Geodetic Vertical Datum of 1929 (NGVD); the elevation reference marks used in this study are shown and described on the maps.

Flood elevations may be raised by debris blockage of the streams in the study area. The hydraulic analyses for this study, however, are based only on the effect of unobstructed flow. The flood elevations as shown on the profiles are thus considered valid only if hydraulic structures in general remain unobstructed and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage state and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is used to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the flood elevations at each cross section; between cross sections, the boundaries were interpolated using limited planimetric maps at a scale of 1:500, with several contours in the flood plain at an approximate contour interval of five feet. In case where the 100-year and the 500-year boundary are close together only the 100-year boundary has been shown.

Small areas within the flood boundaries may lie above the flood elevations; therefore, they would not be subject to flood. Owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodway proposed for this study was computed on the basis of equal conveyance reduction from each side of the flood plain.

As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway boundaries were determined at cross sections; between cross section, the boundaries were interpolated. Table 2 is a list of floodway data.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE (FT.)
Valley Creek							
BB[2]	46.87	513	5,197	3.2	503.6	502.6	1.0
BC[2]	47.15	767	6,505	2.5	504.2	503.2	1.0
BD[2]	47.42	215	1,869	8.6	506.3	505.3	1.0
BE[2]	47.76	500	4,192	3.8	510.8	509.8	1.0
Unnamed Creek 46							
A	0.10	33	242	8.0	502.5[3]	501.2[3]	1.3
B	0.12	379	1,004	1.9	506.5	505.5	1.0
C	0.22	128	431	4.5	507.1	506.1	1.0
D	0.27	500	5,106	0.4	513.8	512.8	1.0
E	0.36	751	1,978	1.0	513.8	512.8	1.0
F	0.41	420	1,601	1.2	514.0	513.0	1.0
G	0.52	26	173	10.5	517.0	516.0	1.0

[1]Miles above mouth.
[2]Floodway width extends beyond corporate limits
[3]Elevations computed without consideration of backwater effects

TABLE 2

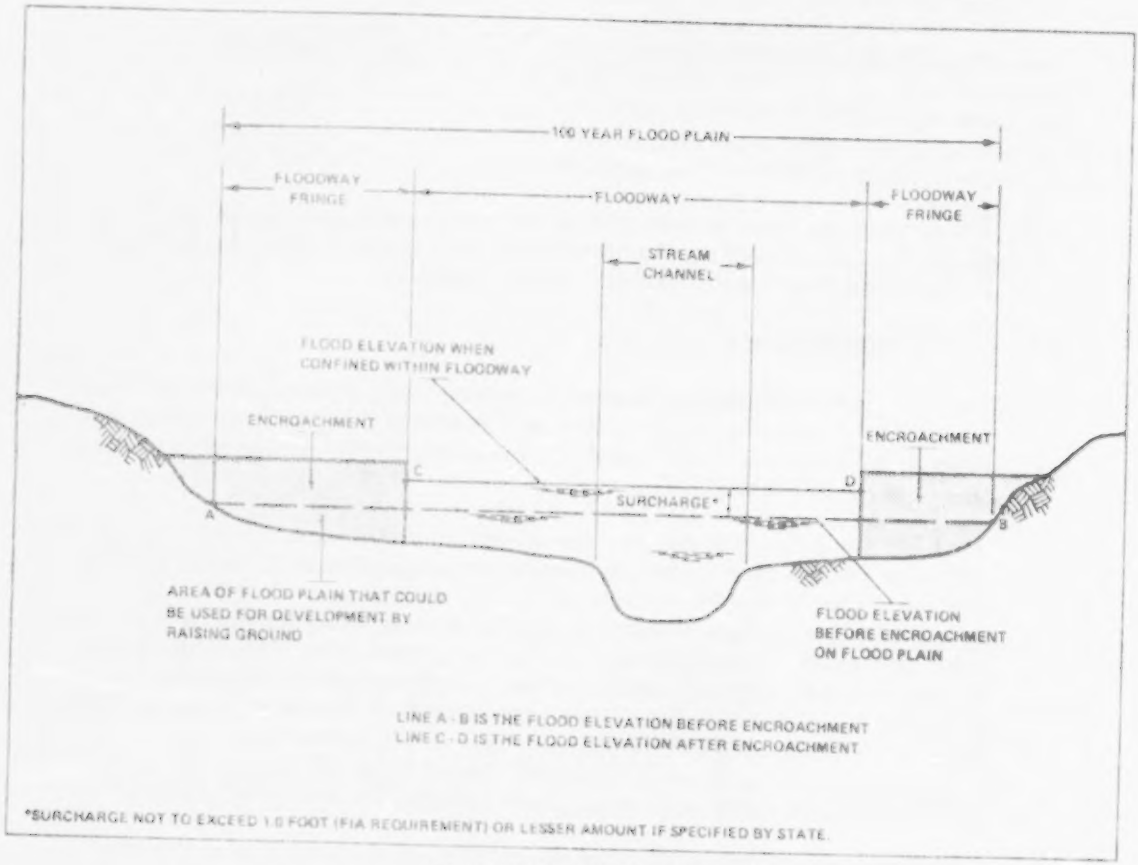
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF MIDFIELD, AL
(JEFFERSON CO.)

FLOODWAY DATA

VALLEY CREEK-UNNAMED CREEK 46

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 4.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC

Figure 4

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source studied in detail affecting the City of Midfield.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet

The location of reaches determined for the flooding sources of the City of Midfield are shown on the Flood Profiles (Exhibit 1) and summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of Midfield was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A5:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevation for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Midfield is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Valley Creek Reach 1	0003,0004	-2.54	-0.8	+1.63	025	A5	variable
Unnamed Creek 46 Reach 1	0003	-2.37	-0.56	+1.12	025	A5	variable

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT – SEE MAP

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF MIDFIELD, AL

(JEFFERSON CO.)

FLOOD INSURANCE ZONE DATA

VALLEY CREEK-UNNAMED CREEK 46

6.0 OTHER STUDIES

The USGS prepared a flood report on Valley Creek after the heavy rains of March 19-20, 1970. Their hydrology was based on a rural land use for the entire basin. As a result of the rural land approach, the return frequency of a given storm is less frequent than that indicated by this study. This is more significant in the upper reaches of Valley Creek basin, which are highly urbanized. Subsequent contacts were made with the USGS. They agree that the return frequency interval (probability of occurrence) should be decreased because of the increasing urban nature of the upper regions of the Valley basin.

In the lower portion of Valley Creek basin, a flood frequency analysis was performed by Betz-Converse-Murdoch-Inc. for 24 years of record of flood data (1954 through 1977 at the Oak Grove Gaging Station). There was good correlation between the flood frequency analysis of gage data and the results of the hydrologic analysis for this study.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Office of the Federal Emergency Management Agency, Insurance and Mitigation Division, 1375 Peachtree Street, N.E., Atlanta, Georgia 30309.

8.0 BIBLIOGRAPHY AND REFERENCES

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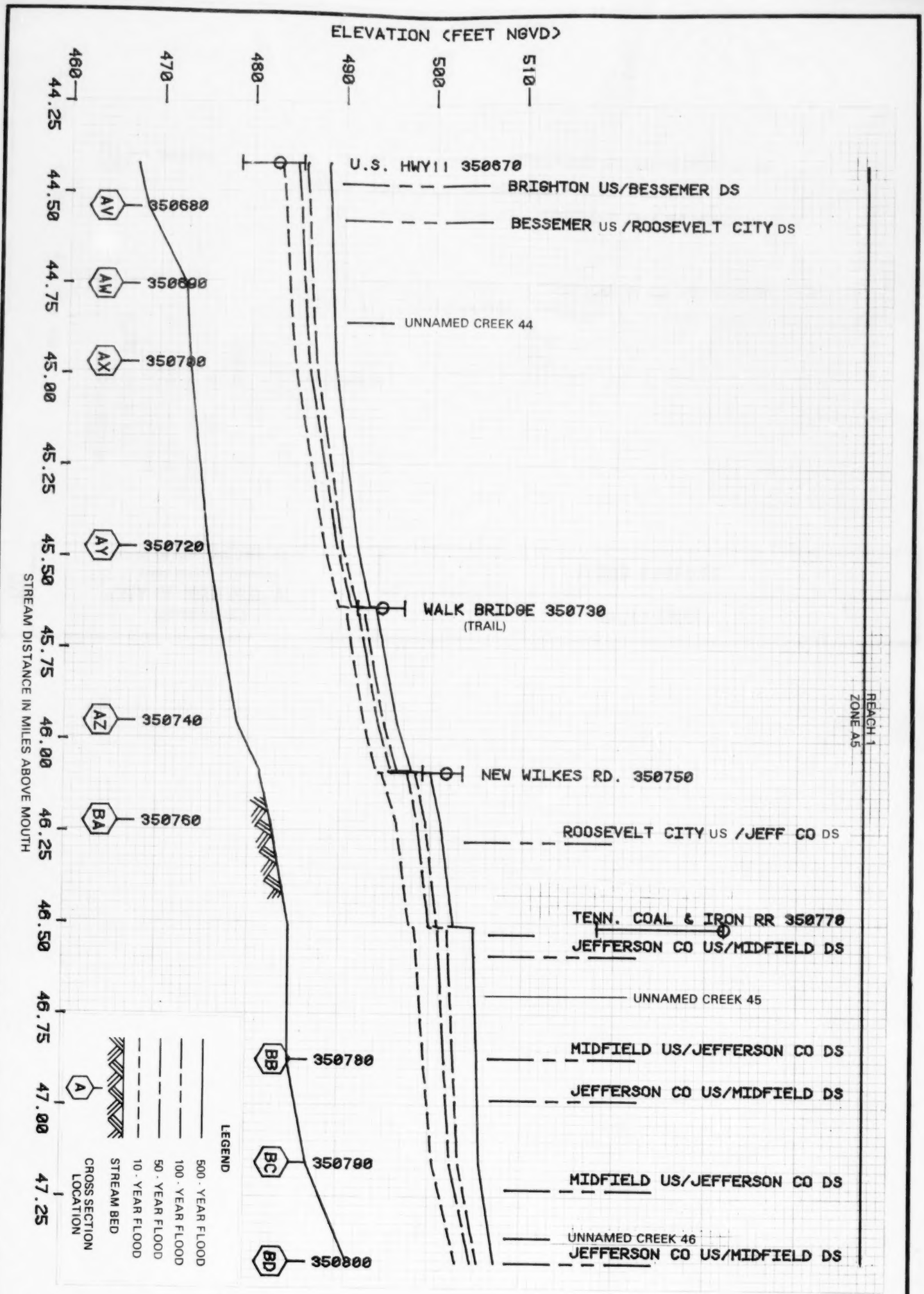
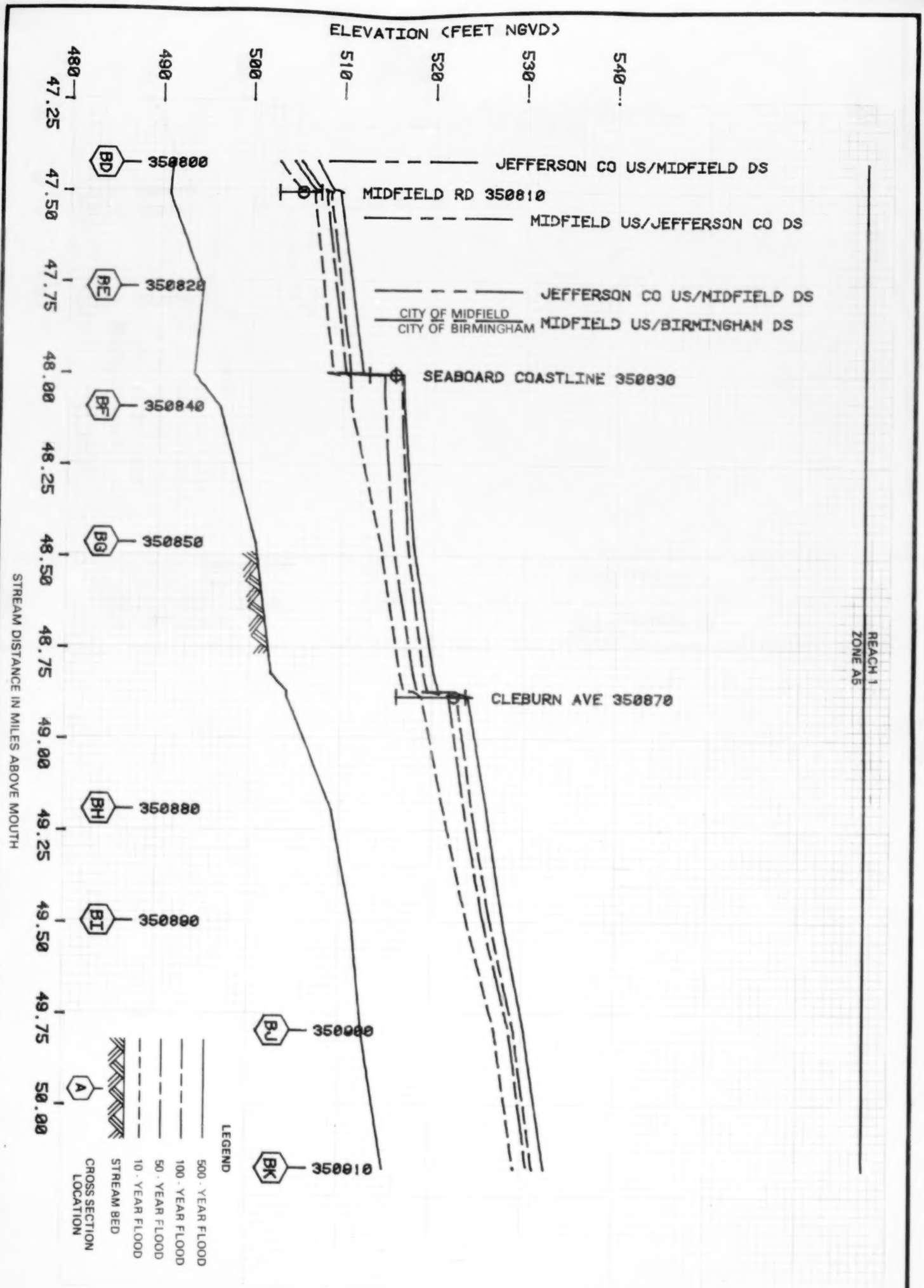
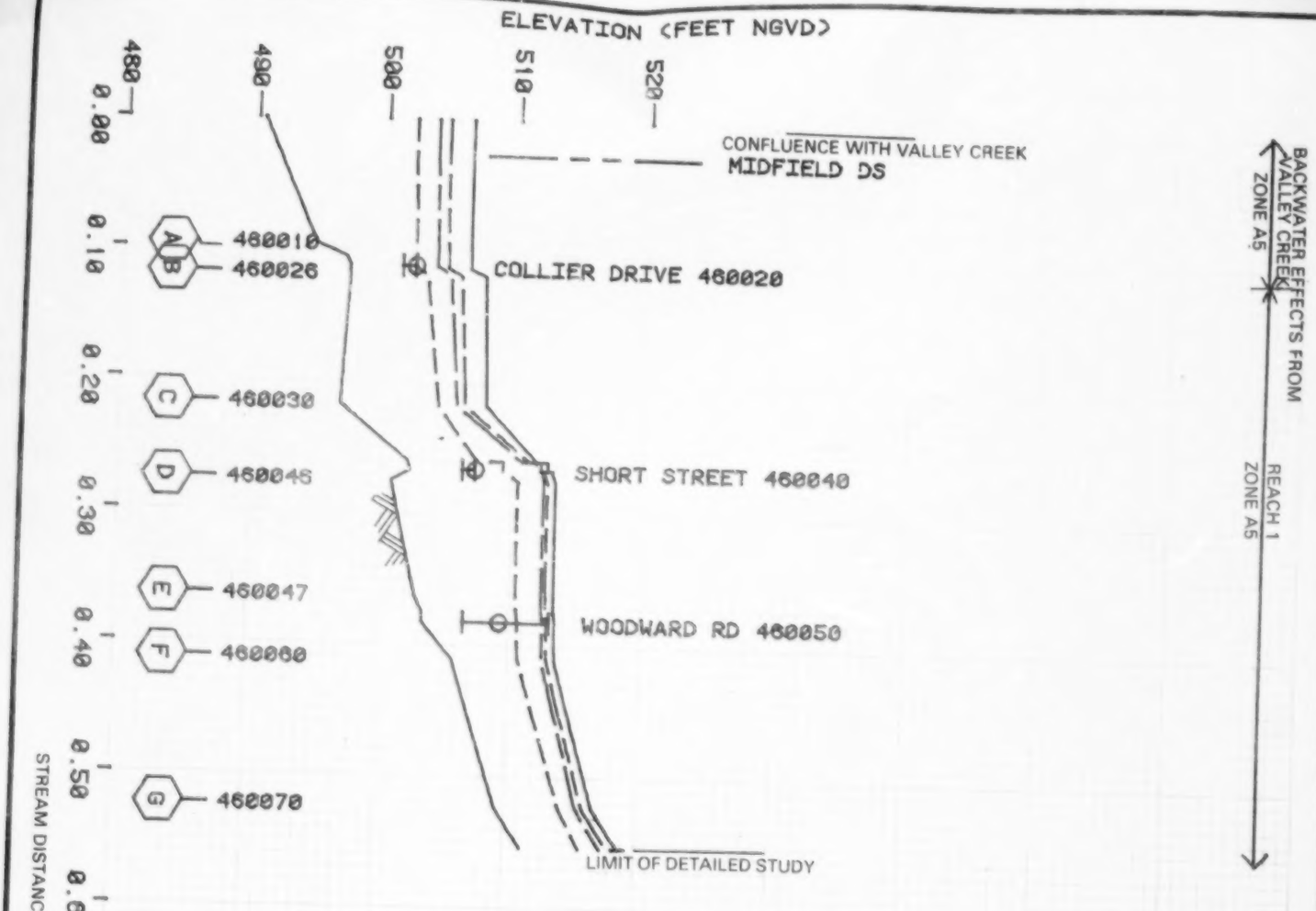
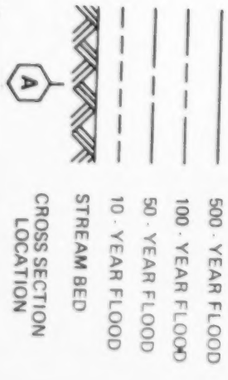


01P	FEDERAL EMERGENCY MANAGEMENT AGENCY Federal Insurance Administration **CITY OF MIDFIELD, AL** (JEFFERSON CO.)	**FLOOD PROFILES** **VALLEY CREEK**



02P	FEDERAL EMERGENCY MANAGEMENT AGENCY Federal Insurance Administration **CITY OF MIDFIELD, AL** (JEFFERSON CO.)	**FLOOD PROFILES** **VALLEY CREEK**





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